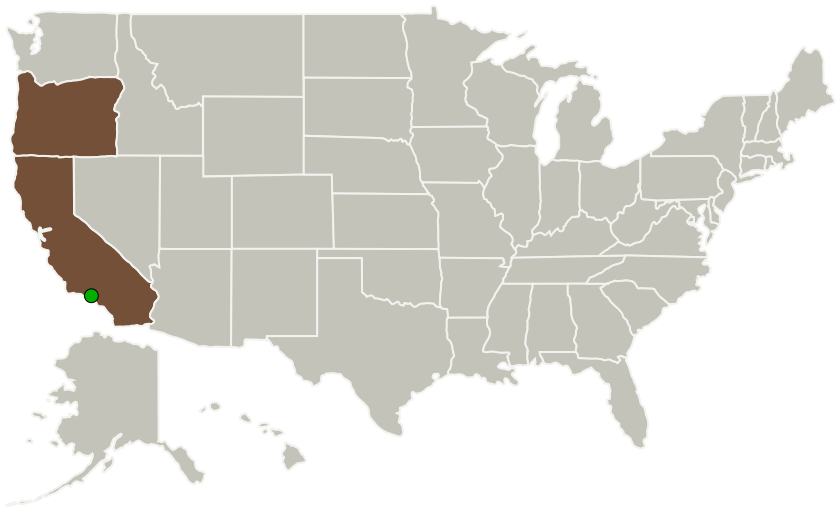
Hole-Initiated-Avalanche, Linear-Mode, Single-Photon-Sensitive Avalanche Photodetector with Reduced Excess Noise and Low Dark Count Rate, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

A radiation hard, single photon sensitive InGaAs avalanche photodiode (APD) receiver technology will be demonstrated useful for long range space based optical telecommunications in the spectral range from 1000 to 1600 nm. The innovation is based on a linear mode (lm) single photon sensitive APD technology for which avalanche gain as high as M = 8000 has been demonstrated. Single photon detection efficiency (PDE) up to 80% has been demonstrated at 1064 nm, as well as maximum count rates in excess of 300 MHz. In the proposed effort, the dark count rate of these detectors will be reduced to the order of kHz while preserving PDE and maximum count rate. Detector dark current will be lowered by two orders of magnitude through implementation of the APD design using aluminum-free alloys with 100x lower trap density than the current design. In Phase I, a series of single element detectors of varying diameter, as well as small sized arrays, will be fabricated from the new aluminum-free material, and the corresponding decrease in dark count rate will be measured. In Phase II, radiation and lifetime testing will be repeated for the aluminum-free design, and large-area segmented detectors will be coupled to readout integrated circuits and demonstrated. Voxtel anticipates that its technology will enter the program at TRL=4, finish Phase I at TRL=5, and exit the Phase II program at TRL=6.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Voxtel, Inc.	Lead Organization	Industry	Beaverton, Oregon
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Oregon

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138596)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Voxtel, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

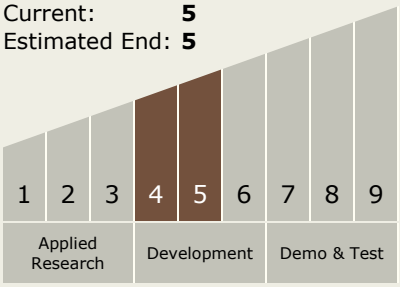
Carlos Torrez

Principal Investigator:

Andrew Huntington

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.1 Detector Development

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System